

Assessment Evidence Guide

For

“ ”

Level-2

Module name
(Formative Assessment)

8th -12th March 2021



**National Vocational & Technical
Training Commission**

Title of Qualification: Senior Caster	CS Code:	Level: 2	Version: 01
Competency Standard Title: Perform Investment Casting	Assessment Date (DD/MM/YY): Assessment Time:		

Candidate Details	Name: Registration/Roll Number:.....
Guidance for Candidate	<p>To meet this standard, you are required to complete the following within the given time frame (for practical demonstration & assessment) as per the instructions given in Annexure A:</p> <p>Assessment Task 1: Candidate is required to: Arrange pattern for casting</p> <p>Assessment Task 2: Candidate is required to: Create mold for casting.</p> <p>Assessment Task 3: Candidate is required to: Cast molten metal in mold</p> <p>Assessment Task 4: Candidate is required to: Perform post-casting operations</p> <p>And complete:</p> <ol style="list-style-type: none"> 1. Knowledge assessment test (Written or Oral) 2. Portfolios at the time of assessment (if any)
Minimum Evidence Required	<p>During a practical assessment, under observation by an assessor, you will complete:</p> <p>Assessment Task 1</p> <ul style="list-style-type: none"> • Arrange wax patterns as per requirement • Use cores to form any internal features on the pattern if required • Attach patterns to a central wax gating system (sprue, runners, and risers) to form a tree-like assembly <p>Assessment Task 2</p> <ul style="list-style-type: none"> • Place wax tree-like assembly into mold flask • Prepare slurry by mixing ceramic powder with water and stir it homogenously • Perform degassing of slurry in vacuum chamber

	<ul style="list-style-type: none"> • Pour slurry into the flask to coat the wax pattern tree • Bake the shell as per standard to form a ceramic shell around the patterns and gating system • Remove the wax leaving a hollow ceramic shell that acts as a one-piece mold
	Assessment Task 3 <ul style="list-style-type: none"> • Pre-heat mold in a furnace as per SOP • Apply protective coating to mold as per standard • Pour molten metal from a ladle into the gating system of the mold • Carry out complete filling of the mold cavity with liquid melt as per standard operating procedure
	Assessment Task 4 <ul style="list-style-type: none"> • Allow for adequate solidification time into the shape of the final casting • Break the ceramic mold and remove the casting as per SOP • Separate the parts from the gating system by either sawing or cold breaking (using liquid nitrogen) • Perform finishing operations such as grinding or sandblasting to smooth the part at the gates • Clean up work area and equipment and dispose of waste according to environmental requirements
	Portfolios required at the time of assessment (if any) for

Continued on following page

Assessors Judgment Guide (to be completed by the Assessor and signed both by the assessor and the candidate after the assessment)

Candidate Details	Name: Registration/Roll Number: Candidate Signature:
Assessment Outcome	COMPETENT <input type="checkbox"/> NOT YET COMPETENT <input type="checkbox"/> Name of the Assessor: Assessor's code: Signature of the Assessor:

Assessment Summary (to be filled by the assessor)							
Activity	Method					Result	
Nature of Activity	Written	Oral	Observation	Portfolio	Role Play	Competent	Not Yet Competent
Practical Skill Demonstration			✓				
Knowledge Assessment	✓	✓					
Other Requirement							

Each Assessment Task (with performance criteria)				
Assessment Task 1		Description of assessment task 1		
During the practical assessment, candidate demonstrated the following:		Yes	No	Remarks
1.	Arrangement of wax patterns as per requirement			
2.	Use of cores to form any internal features on the pattern			
3.	Attach patterns to a central wax gating system (sprue, runners, and risers) to form a tree-like assembly			
Competent <input type="checkbox"/>		Not Yet Competent <input type="checkbox"/>		

Assessment Task 2		Description of assessment task 2		
During the practical assessment, candidate demonstrated the following:		Yes	No	Remarks
1.	Place wax tree-like assembly into mold flask			
2.	Prepare slurry by mixing ceramic powder with water and stir it homogenously			
3.	Perform degassing of slurry in vacuum chamber			
4.	Pour slurry into the flask to coat the wax pattern tree			
5.	Bake the shell as per standard to form a ceramic shell around the patterns and gating system			
6.	Remove the wax leaving a hollow ceramic shell that acts as a one-piece mold			
Competent <input type="checkbox"/>		Not Yet Competent <input type="checkbox"/>		

Assessment Task 3		Description of assessment task 3		
During the practical assessment, candidate demonstrated the following:		Yes	No	Remarks
1.	Pre-heat mold in a furnace as per SOP			
2.	Apply protective coating to mold as per standard			
3.	Pour molten metal from a ladle into the gating system of the mold			
4.	Carry out complete filling of the mold cavity with liquid melt as per standard operating procedure			
Competent <input type="checkbox"/>		Not Yet Competent <input type="checkbox"/>		

Assessment Task 4		Description of assessment task 4		
During the practical assessment, candidate demonstrated the following:		Yes	No	Remarks
1.	Allow for adequate solidification time into the shape of the final casting			
2.	Break the ceramic mold and remove the casting as per SOP			
3.	Separate the parts from the gating system by either sawing or cold breaking (using liquid nitrogen)			
4.	Perform finishing operations such as grinding or sandblasting to smooth the part at the gates			
Competent <input type="checkbox"/>		Not Yet Competent <input type="checkbox"/>		

Title of Qualification: Senior Caster	CS Code:	Level: 2	Version: 01
Competency Standard Title: Perform Investment Casting	Assessment Date (DD/MM/YY): Assessment Time: 30 min		

Guidance for Candidate	To complete your assessment for this Competency Standard, you need to answer the questions on the following pages successfully.
------------------------	--

Assessors Guide (to be completed by the Assessor and signed both by the assessor and the candidate after the assessment)

Candidate Details	Name:..... Registration/Roll Number: Candidate Signature:
Written Assessment Outcome	COMPETENT <input type="checkbox"/> NOT YET COMPETENT <input type="checkbox"/> Name of the Assessor: Assessor's code: Signature of the Assessor:

Title of Qualification: Senior Caster	CS Code:	Level:2	Version:01
Competency Standard Title: Perform Investment Casting	Assessment Date (DD/MM/YY): Assessment Time: 30 min		

WRITTEN ASSESSMENT

Question	Candidate's answer
1. Why investment casting is named so?	<ul style="list-style-type: none"> Because the process invests (surrounds) the pattern with refractory material to make a mold, and a molten substance is cast into the mold.
2. What is the main advantage of using investment casting?	<ul style="list-style-type: none"> Due to the hardness of refractory materials used, investment casting can produce products with exceptional surface qualities, which can reduce the need for secondary machine processes.
3. Name 2 primary investment casting methods used nowadays?	<ul style="list-style-type: none"> Water glass Silica sol investment casting
4. What is the difference between water glass and Silica sol method?	<ul style="list-style-type: none"> Water glass method dewaxes into the high-temperature water, and the ceramic mold is made of water glass quartz sand. Silica sol method dewaxes into the flash fire, and silica sol zircon sand makes the ceramic mold.
5. Compare Silica sol method and water glass method in terms of cost and surface finish?	<ul style="list-style-type: none"> Silica sol method costs more but has the better surface than the water glass method.
6. Mention main advantages of investment casting?	<ul style="list-style-type: none"> Investment casting can produce complicated shapes that would be difficult or impossible with other casting methods. It can also produce products with exceptional surface qualities Low tolerances can be achieved with minimal surface finishing or machining required.
7. By which material and method casting can be made in investment casting?	<ul style="list-style-type: none"> Castings can be made from an original wax model (the direct method) or from wax replicas of an original pattern that need not be made from wax (the indirect method).

Question	Candidate's answer
8. Mention the steps of Indirect casting process?	<ol style="list-style-type: none"> 1. Produce a master pattern 2. Create a mold 3. Produce wax patterns 4. Assemble wax patterns 5. Apply investment materials 6. Dewax 7. Burnout pre-heating 8. Pouring 9. Divesting 10. Finishing
9. Mention few advantages of investment casting?	<ul style="list-style-type: none"> • Excellent surface finish • High dimensional accuracy • Extremely intricate parts are castable • Almost any metal can be cast • No flash or parting lines
10. Mention few disadvantages of investment casting?	<ul style="list-style-type: none"> • Difficult to cast objects requiring cores. • Process is expensive, is usually limited to small casting, and presents some difficulties where cores are involved. • Holes cannot be smaller than 1/16 in. (1.6 mm) and should be no deeper than about 1.5 times the diameter. • Require longer production cycles compared to other casting processes.
11. Mention few fields where investment casting is being used?	<ul style="list-style-type: none"> • Aerospace to produce turbine blades with complex shapes • Power generation industries cooling systems • Firearms manufacturers to fabricate firearm receivers, triggers, hammers, and other precision parts • 3D printing use to make much larger sacrificial molds used in investment casting
12. Mention dimensional accuracy for investment casting?	<ul style="list-style-type: none"> • Typically, "standard" investment tolerances are ± 0.010" for the first inch and ± 0.004" for each succeeding inch.

Annexure A: